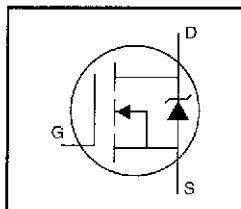


## HEXFET® Power MOSFET

- Isolated Package
- High Voltage Isolation= 2.5KV RMS ⑤
- Sink to Lead Creepage Dist.= 4.8mm
- Logic-Level Gate Drive
- $R_{DS(on)}$  Specified at  $V_{GS}=4V$  &  $5V$
- Fast Switching
- Ease of Paralleling



$$V_{DS} = 60V$$

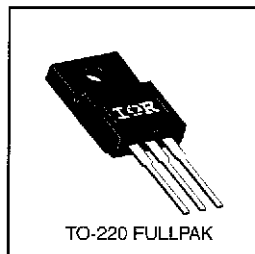
$$R_{DS(on)} = 0.028\Omega$$

$$I_D = 30A$$

## Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-220 Fullpak eliminates the need for additional insulating hardware in commercial-industrial applications. The moulding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. This isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The Fullpak is mounted to a heatsink using a single clip or by a single screw fixing.



TO-220 FULLPAK

DATA  
SHEETS

## Absolute Maximum Ratings

Parameter	Max.	Units
$I_D$ @ $T_C = 25^\circ C$	Continuous Drain Current, $V_{GS}$ @ 5.0 V	30
$I_D$ @ $T_C = 100^\circ C$	Continuous Drain Current, $V_{GS}$ @ 5.0 V	21
$I_{DM}$	Pulsed Drain Current ①	120
$P_D$ @ $T_C = 25^\circ C$	Power Dissipation	48
	Linear Derating Factor	0.32
$V_{GS}$	Gate-to-Source Voltage	$\pm 10$
$E_{AS}$	Single Pulse Avalanche Energy ②	400
$dv/dt$	Peak Diode Recovery $dv/dt$ ③	4.5
$T_J$	Operating Junction and Storage Temperature Range	-55 to +175
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)
	Mounting Torque, 6-32 or M3 screw	10 lbf-in (1.1 N-m)

## Thermal Resistance

Parameter	Min.	Typ.	Max.	Units
$R_{JC}$	Junction-to-Case	—	3.1	$^\circ C/W$
$R_{JA}$	Junction-to-Ambient	—	65	

Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	60	—	—	V	$V_{GS}=0V$ , $I_D=250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.070	—	$^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D=1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.028	$\Omega$	$V_{GS}=5.0V$ , $I_D=18A$ ③
		—	—	0.039		$V_{GS}=4.0V$ , $I_D=15A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	2.0	V	$V_{DS}=V_{GS}$ , $I_D=250\mu A$
$g_{fs}$	Forward Transconductance	22	—	—	S	$V_{DS}=25V$ , $I_D=18A$ ④
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS}=60V$ , $V_{GS}=0V$
		—	—	250		$V_{DS}=48V$ , $V_{GS}=0V$ , $T_J=150^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS}=10V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS}=-10V$
$Q_g$	Total Gate Charge	—	—	66	nC	$I_D=51A$
$Q_{gs}$	Gate-to-Source Charge	—	—	12		$V_{DS}=48V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	43		$V_{DS}=5.0V$ See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	17	—	ns	$V_{DD}=30V$
$t_r$	Rise Time	—	230	—		$I_D=51A$
$t_{d(off)}$	Turn-Off Delay Time	—	42	—		$R_G=4.6\Omega$
$t_f$	Fall Time	—	110	—		$R_D=0.56\Omega$ See Figure 10 ④
$L_D$	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6 mm (0.25in.) from package and center of die contact
$L_S$	Internal Source Inductance	—	7.5	—		
$C_{iss}$	Input Capacitance	—	3300	—	pF	$V_{GS}=0V$
$C_{oss}$	Output Capacitance	—	1200	—		$V_{DS}=25V$
$C_{rss}$	Reverse Transfer Capacitance	—	200	—		$f=1.0MHz$ See Figure 5
$C$	Drain to Sink Capacitance	—	12	—	pF	$f=1.0MHz$



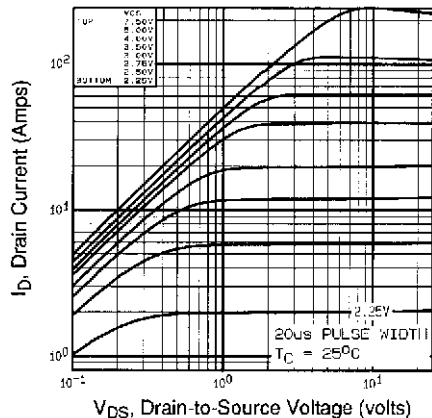
## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	30	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	120		
$V_{SD}$	Diode Forward Voltage	—	—	2.5	V	$T_J=25^\circ\text{C}$ , $I_S=30A$ , $V_{GS}=0V$ ②
$t_{rr}$	Reverse Recovery Time	—	90	180	ns	$T_J=25^\circ\text{C}$ , $I_F=51A$
$Q_{rr}$	Reverse Recovery Charge	—	0.65	1.3	$\mu C$	$di/dt=100A/\mu s$ ③
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				

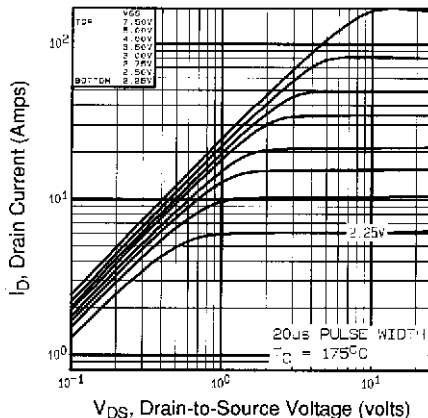
Notes:

① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)

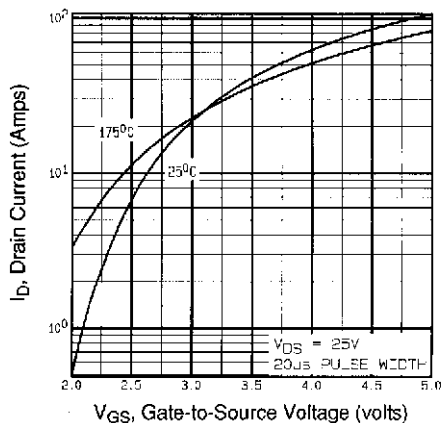
②  $I_{SD} \leq 51A$ ,  $di/dt \leq 250A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 175^\circ\text{C}$ ③  $t=60s$ ,  $f=60Hz$ ④  $V_{DD}=25V$ , starting  $T_J=25^\circ\text{C}$ ,  $L=518\mu H$ ,  $R_G=25\Omega$ ,  $I_{AS}=30A$  (See Figure 12)⑤ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .



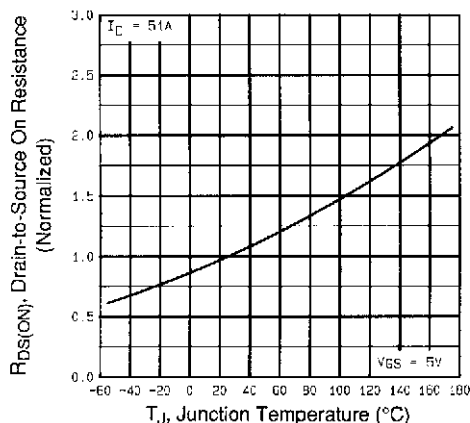
**Fig 1.** Typical Output Characteristics,  
 $T_C = 25^\circ\text{C}$



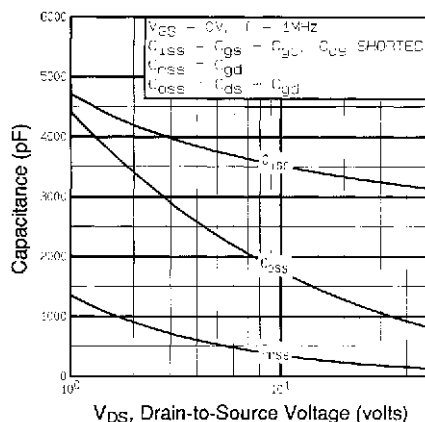
**Fig 2.** Typical Output Characteristics,  
 $T_C = 175^\circ\text{C}$



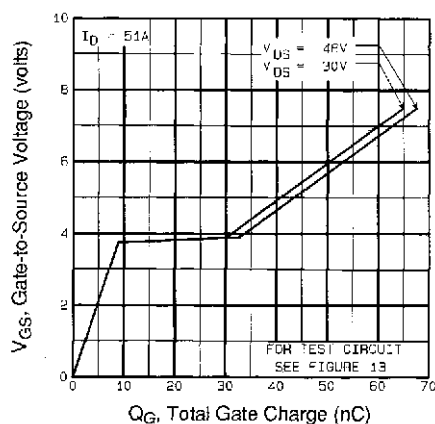
**Fig 3.** Typical Transfer Characteristics



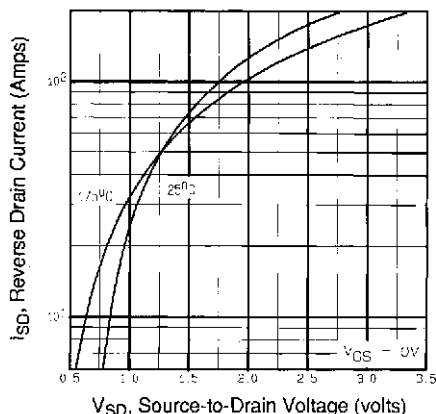
**Fig 4.** Normalized On-Resistance  
Vs. Temperature



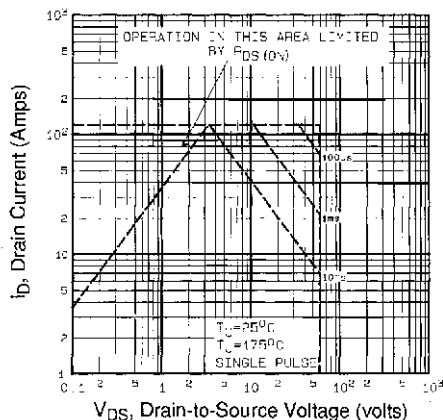
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



**Fig 7.** Typical Source-Drain Diode Forward Voltage



**Fig 8.** Maximum Safe Operating Area

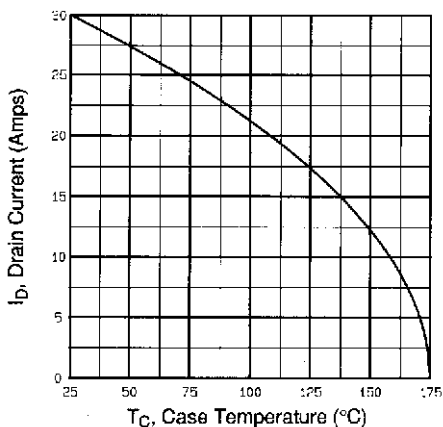


Fig 9. Maximum Drain Current Vs. Case Temperature

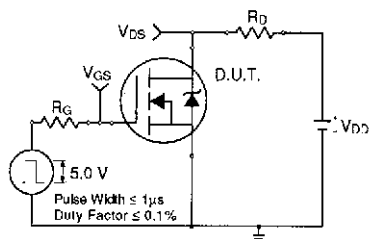


Fig 10a. Switching Time Test Circuit

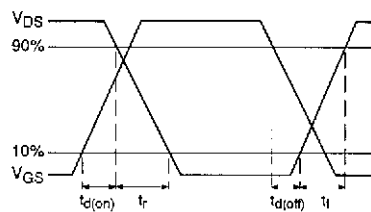


Fig 10b. Switching Time Waveforms

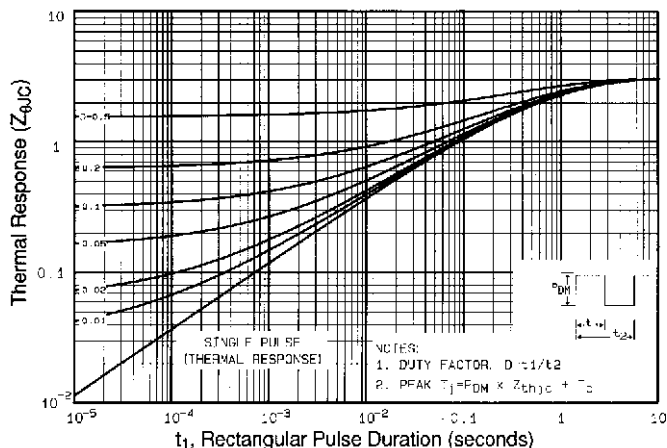


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

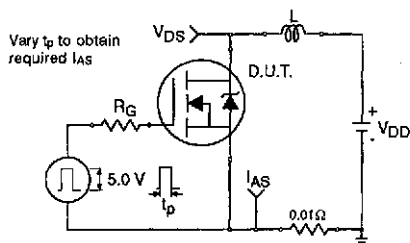


Fig 12a. Unclamped Inductive Test Circuit

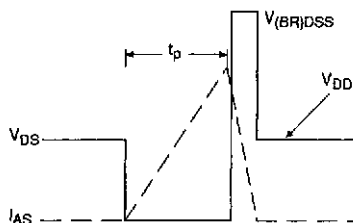


Fig 12b. Unclamped Inductive Waveforms

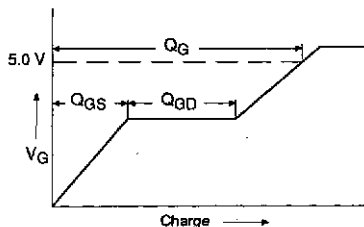


Fig 13a. Basic Gate Charge Waveform

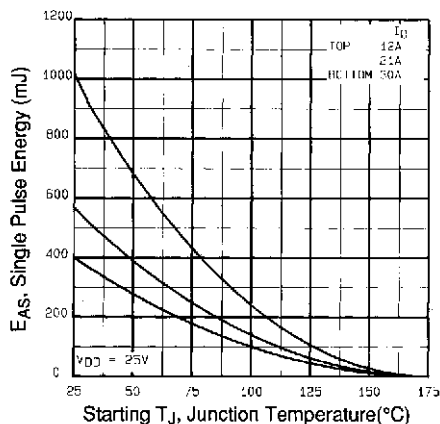


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

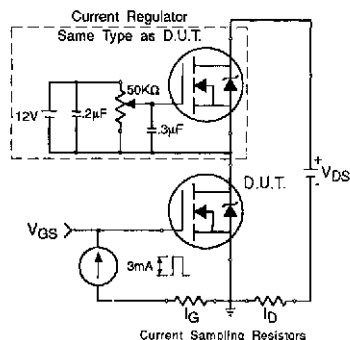


Fig 13b. Gate Charge Test Circuit

**Appendix A:** Figure 14, Peak Diode Recovery  $dv/dt$  Test Circuit – See page 1505

**Appendix B:** Package Outline Mechanical Drawing – See page 1510

**Appendix C:** Part Marking Information – See page 1517

**International**  
**Rectifier**



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